

aqueous electrolyte includes an organic peroxide.

[0034]

The organic peroxide includes at least one selected form the group consisting of hydroperoxides, dialkylperoxides, peroxy esters, diacylperoxides, peroxyketals, and ketone peroxides.

[0035]

Exemplary hydroperoxides include: those with a saturated hydrocarbon group or an aromatic hydrocarbon group, such as methyl hydroperoxide, ethyl hydroperoxide, isopropyl hydroperoxide, t-butyl hydroperoxide, and cumene peroxide; and peracids such as performic acid, peracetic acid, and m-chloroperbenzoic acid.

Exemplary dialkylperoxides include diethyl peroxide, di-t-butyl peroxide, dicumyl peroxide, 2,5-dimethyl-2,5-t-butylperoxy hexane, 1,3-bis-t-butylperoxy isopropyl benzene, t-butyl cumyl peroxide, and di-t-butyl peroxide.

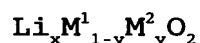
Exemplary peroxy esters include  $\alpha$ -cumyl peroxyneodecanate, and exemplary diacylperoxides include diisobutyryl peroxide, bis-3,5,5-trimethyl hexanoyl peroxide, dilauroyl peroxide, and benzoyl peroxide. Also, peroxyketals include 1,1-di-t-butylperoxy cyclohexane.

[0036]

## CLAIMS

1. (Amended) A lithium secondary battery comprising:  
a positive electrode including a positive electrode active material; a negative electrode including a negative electrode active material; and a non-aqueous electrolyte,

wherein said positive electrode active material comprises at least one lithium-containing composite oxide represented by the following general formula:



where  $\text{M}^1$  and  $\text{M}^2$  are different elements,  $\text{M}^1$  is Ni or Co,  $\text{M}^2$  is at least one selected from Ni, Co, Mn, Mg, and Al,  $1 \leq x \leq 1.05$ , and  $0 \leq y \leq 0.7$ ,

said negative electrode active material comprises at least one selected from the group consisting of silicon, tin, a silicon-containing alloy, and a tin-containing alloy,

at least one of said positive electrode, said negative electrode, and said non-aqueous electrolyte includes an organic peroxide, and

said organic peroxide is at least one selected from the group consisting of hydroperoxides, dialkylperoxides, peroxy esters, diacylperoxides, peroxyketals, and ketone peroxides.

2. (Deleted)

3. (Amended) The lithium secondary battery in accordance with claim 1, wherein said organic peroxide is

included in said non-aqueous electrolyte, and said organic peroxide accounts for 0.1 to 5 % by weight of said non-aqueous electrolyte.

4. (Deleted)

5. The lithium secondary battery in accordance with claim 1 or 3, wherein said organic peroxide is included in said negative electrode.

6. The lithium secondary battery in accordance with claim 1, wherein said negative electrode active material comprises a silicon-containing alloy.

7. The lithium secondary battery in accordance with claim 6, wherein said silicon-containing alloy comprises: a solid solution including silicon and at least one transition metal element selected from the group consisting of Ti, Ni, Co, Fe, and Cu; or an alloy including silicon and at least one intermetallic compound selected from the group consisting of  $\text{TiSi}_2$ ,  $\text{TiSi}$ ,  $\text{CoSi}_2$ ,  $\text{CoSi}$ ,  $\text{FeSi}_2$ ,  $\text{FeSi}$ ,  $\text{NiSi}_2$ ,  $\text{NiSi}$ , and  $\text{Cu}_3\text{Si}$ .

8. The lithium secondary battery in accordance with claim 7, wherein said intermetallic compound is  $\text{TiSi}_2$ .

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2005/004443

## A. CLASSIFICATION OF SUBJECT MATTER

Int.Cl.<sup>7</sup> H01M10/40, 4/02, 4/38, 4/58

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

Int.Cl.<sup>7</sup> H01M10/40, 4/02, 4/38, 4/58

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Jitsuyo Shinan Koho	1922-1996	Jitsuyo Shinan Toroku Koho	1996-2005
Kokai Jitsuyo Shinan Koho	1971-2005	Toroku Jitsuyo Shinan Koho	1994-2005

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	JP 2003-157896 A (Matsushita Electric Industrial Co., Ltd.), 30 May, 2003 (30.05.03), Par. Nos. [0019], [0037], [0040], [0049] (Family: none)	1, 3-4, 6-8 2, 5
A	JP 2001-148242 A (Seiko Instruments Inc.), 29 May, 2001 (29.05.01), Par. No. [0027]. & <u>US-6489062 B1</u>	1-8
A	JP 2004-47317 A (Japan Storage Battery Co., Ltd.), 12 February, 2004 (12.02.04), Full text (Family: none)	1-8

☐ Further documents are listed in the continuation of Box C.☐ See patent family annex.

## \* Special categories of cited documents:

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- "&" document member of the same patent family

Date of the actual completion of the international search  
08 April, 2005 (08.04.05)Date of mailing of the international search report  
26 April, 2005 (26.04.05)Name and mailing address of the ISA/  
Japanese Patent Office

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